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EXAMINER	
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ART UNIT	PAPER NUMBER
1746	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/742,423	Applicant(s) MATSUNO ET AL.	
	Examiner Michael Kornakov	Art Unit 1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 October 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) *2, 21-23* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-23* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 July 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1 and 3-20 in Paper No. 7 is acknowledged. The traversal is on the ground(s) that:

- A) without "further information", the relationship between the Groups of claims indicated by the Examiner "lacks grounds upon which it can be evaluated whether in fact these propositions are separately usable";

- B) there is no serious burden on the Examiner to examine all groups of claims. This is not found persuasive because of the reasons clearly set forth in Paper No. 6, hereinafter referred to as "restriction requirement".

With regard to argument (a), inventions I and II are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention of Group I, claims 1, 3-20 was shown to have separate utility, such as any surface modification or pickling with acidic solution, which is performed as a separate step after pre-cleaning the said surface with ozonated water. See MPEP § 806.05(d). Inventions I and III or II and III are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case, as shown in Paper No.6 both conditions apply: the claimed process can be

practiced by submerging substrate in a processing liquid in a treatment tank, wherein the rotation means are not required, or even treatment solution can be sprayed on the substrate. On the other hand the apparatus as claimed can be utilized for coating, which is materially different from the instantly claimed process.

With regard to argument (b), the statement that there is no serious burden on the Examiner to examine all groups of claims is not found persuasive because the consideration of undue burden is one that must be made by the Examiner, Applicants' arguments that the search of one invention must necessarily result in a search of the other one has been considered, but is not persuasive insofar as the searches are not co-extensive and additional search would of necessity, be required for the combination of inventions.

The requirement is still deemed proper and is therefore made ***FINAL.***

Specification

2. The disclosure is objected to because of the following: the relevance of JP 10-298585 reference, which is recited on page 3, line 16, is not readily ascertainable. JP'585 presented as a reference describing ozone cleaning after ashing. However, it recites "REDUCTION IN FRICTION RESISTANCE IN PIPINGS FOR WATER-BASED HEAT-CONVEYING MEDIUM" and is not directed to the method as presented. Appropriate clarification and correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 3, 8, 9, 13, 19 and 20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The language of Claim 3 is indefinite because it uses an improper form of a Markush Group for alternative recitation of substrates to be cleaned. When groups recited in a claim are so related as to constitute a proper Markush group, they should be recited in the conventional manner or in the alternative, for example, " ... selected from the group, consisting of A, B, C and D'".

Claims 8, 9, 15, 19 and 20 recite the limitation "ozone-hydrogen water". There is insufficient antecedent basis for this limitation in the claim. Claim 1, upon which claims 8, 9, 19 and 20 depend, recites **only separately** ozone water and hydrogen water.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim1 and 3-7, 9, 10, 12, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeol et al (U.S. 5,983,909) in view of "Handbook of Semiconductor Wafer Cleaning Technology" (1993), by Werner Kern (Noyes Publications 1993), page 120, hereinafter referred to as "Handbook".

With regard to claims 1, 3, 4, Yeol discloses substrate treatment process to remove organic substances from substrates, **including liquid crystal display**

substrates, or other electronic parts**,** such as semiconductor elements or integrated circuits (see Abstract, col. 1, lines 9-14; col. 2, lines 46-53; col. 9, lines 41-44; col.10, line 1; col. 3, lines 39-44). To achieve such cleaning Yeol employs **two types of solutions, namely ozone water, which is utilized for providing oxidizing property, and hydrogen water for providing reducing property** (col. 2, lines 62-65).

Furthermore, a cleaning method of Yeol comprises: **a step for selectively producing ozone water or hydrogen water by dissolving ozone gas or hydrogen gas, respectively, in pure water** (col. 3, lines 5-8).

With specific regard to claim 5, Yeol explicitly states that his method relates to a cleaning method employed for removing contaminants **adhering to surfaces of substrates and the like during processes for manufacturing liquid crystal display substrates or semiconductors** (col. 1, lines 9-14).

With specific regard to claim 6, Yeol teaches **ozone concentration** of 8 to **10 PPM** in ozone water (col. 9, lines 4, 5, 47, 48), thus 10ppm as being the end point of the range anticipates the limitation of the instant claim 6.

With regard to the limitation of the instant claim 7, Yeol teaches that hydrogen concentration in hydrogen water is 1-2 PPM, thus anticipating the instantly claimed "not lower than 0.5 PPM".

With regard to claim 9, Yeol specifically teaches that the cleaning efficacy can be improved by combining the method with ultrasonic-waves (col. 3, lines 53, 54, col. 6, lines 30-32). When using ultrasonic-waves, the aqueous cleaning solution is supplied to

the cleaning chamber **after passing** through an **ultrasonic** vibration device (col. 12, lines 6-10).

With regard to claim 10, Yeol teaches that a spin cleaning method can be employed, in which a subject is rotated at a high speed while applying an aqueous cleaning solution to the center of rotation (col. 6, lines 26-29).

With regard to claim 12, Yeol teaches that cleaning procedures, each using different types of aqueous cleaning solutions, can be conducted using only one cleaning chamber (col. 11, lines 57-60).

With specific regard to claim 20, Yeol discloses that an acidic solution such as **HF**, HNO_3, etc., can be mixed with hydrogen water in apparatus (D), ref. 9 on Fig.1A, and depending on the sequence of treatments can be used after the ozone water treatment is performed. When an acidic solution such as HF, is mixed with ozone water in the mixing apparatus (C), ref. 8 on Fig.1A, an aqueous oxidizing acidic cleaning solution is produced and can be used before or after hydrogen containing water is applied.

While teaching that two or more types of aqueous cleaning solutions may be used (col.11, lines 64-65), Yeol does not specifically disclose the sequence of utilizing these solution.

However, Yeol teaches that two or more cleaning solutions may be used with respect to the subject sent to the chamber 16 so as to remove a plurality of types of contaminants (col.11, lines 65-67), thus clearly suggesting and motivating a person col 3, line 61-65

skilled in the art to apply a certain sequence of cleaning solutions depending on substrate to be cleaned and types of contaminants to be removed.

Treatment with oxidizing solution and after that with reducing solution is routinely used for cleaning semiconductors, as exemplified in a "Handbook of Semiconductor Wafer Cleaning Technology" on page 120. The teaching is as follows : the first step is cleaning with standard Clean SC-1 **(oxidizing solution)** in order to oxidize organic materials, and thereafter the second step is treatment with SC-2 **(reducing solution)** to remove residual contamination.

Therefore a person skilled in the art, motivated by disclosure of Yeol and teaching of Handbook, would have found it obvious, to utilize the oxidizing solution (ozone water) of Yeol first and thereafter reducing solution (hydrogen water) of Yeol in order to remove organic containing contaminants from semiconductor devices of Yeol and thus to arrive at the instantly claimed subject matter.

Furthermore, selection of any order of performing steps is prima facie obvious in the absence of a new and unexpected results. Consult ***In re Burnhans***, 154F.2d690, 69 USPQ 330 (CCPA 1946). Consult also ***Ex parte Rubin***, 128 USPQ 440 (Bd.App.1959). Therefore, **lacking the showing of criticality of the sequence as per claim 1**, a person skilled in the art would have found it obvious to employ any order of steps, including the one as claimed, with the reasonable expectation of success.

8. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeol (U.S. 5,983,909) in view of Handbook, and in further view of JP 63-271938.

The combined teaching of Yeol and "Handbook" remains silent about subjecting

a substrate surface to ashing with oxidizing gas before either of the steps, ozone water treating step, or hydrogen water treating step.

However, removal of organic matter from substrate surfaces by ashing followed by a washing process is notoriously utilized in the art of manufacturing semiconductor devices.

Thus, JP'938 teaches, that by irradiating ozone on the organic substances to be cleansed (compare to ashing, as instantly claimed) before the substances to be cleansed are cleansed with the cleaning liquid, the organic substances remaining on substrate surface are subjected to chemical change and brought into a state wherein they are easy to remove with the cleaning fluid in a cleaning treatment subsequent to ozone treatment (see Abstract; page 3, paragraph in lower right column).

Since the combined teaching of Yeol and Handbook and JP'938 are both concerned with removal of organic containing contaminants from semiconductor surfaces and JP'938 discloses preliminary treatment of such substrates with ozone, one skilled in the art, motivated by the disclosure of JP'938, would have found it obvious to utilize a preliminary ozone treatment of contaminated substrates of Yeol and Handbook before the wet treatment process as per teaching of Yeol and Handbook in order to improve wettability of cleaned surfaces and enhance removal of organic contaminants in the process of Yeol and Handbook with the reasonable expectation of success.

9. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over combined teaching of Yeol (U.S. 5,983,909), Handbook, and JP 63-271938 and in further view of Sakai et al. (U.S. 4,812,201).

The combined teaching of Yeol (U.S. 5,983,909), Handbook, and JP 63-271938 does not specifically indicate the heating substrate at 300-350°C.

Sakai teaches method and apparatus for ashing organic layers on semiconductor substrates by applying ozone to the layer (col. 1, lines 7-10). Sakai provides a graph, illustrating the relationship between ozone decomposition time and temperature (Fig.5) and teaches that as soon as ozone ashing gas contacts the surface of the heated wafer, it is decomposed, generating oxygen atom radicals, which react with organic layer, ashing and removing it (col.7, lines 15-29). As can be seen from the graph and provided by Sakai, the optimum processing temperature of substrate during the ozone ashing process is 300°C, because this temperature provides for the fastest formation of oxygen radicals and, therefore, the effectiveness of the ashing process is optimized.

Because the combined teaching of Yeol (U.S. 5,983,909), Handbook, and JP 63-271938 is concerned with ozone ashing processing of semiconductor substrates while Sakai discloses the optimum temperature of 300°C for such processing, one skilled in the art, motivated by disclosure of Sakai, would have found it obvious to utilize the temperature regime of Sakai in order to provide the optimum processing conditions in the ashing process of combined teaching of Yeol (U.S. 5,983,909), Handbook, and JP 63-271938 and thus to arrive at the subject matter, as instantly claimed.

10. Claims 8, 11, 13, 14 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeol in view of "Handbook", and further in view of Carter et al (U.S. 6,080,531).

Yeol in combination with "Handbook" are silent about the rate of ozone water, as per claim 8 and about the value of rotation speed of a substrate, as per claim 11.

Carter discloses an improved method for removal of photoresist by applying the treatment solution containing ozone dissolved in a pure water (abstract, Fig.3, col. 2, lines 65-67, col. 3, lines 1,2). According to Carter all experiments were performed, while wafer was rotated at 999 ppm, and while the total flow of cleaning liquid through the wafer was 1.2-1.32 L/min (col.10, lines 45-51). These two parameters are within the range of claims 8 and 11.

Since Yeol suggests the rotation of wafer with a very high speed (col. 6, line 27), as discussed supra and since both Yeol and Carter perform similar process steps with similar purpose to remove organic contaminants from the surface of wafer, a person skilled in the art at the time the invention was made would have found it obvious to rotate wafer at the speed of Carter and apply the analogous cleaning solution with the rate of Carter in order to achieve the optimum efficiency of cleaning with the reasonable expectation of success.

Yeol in combination with "Handbook" disclose a method as instantly claimed. However, they do not specifically recognize the step of treating substrate with an organic solvent before either one of washing steps, as per claim 19.

Carter discloses an improved method for removal of photoresist by applying the treatment solution containing ozone dissolved in a pure water (abstract, Fig.3, col. 2, lines 65-67, col. 3, lines 1,2). Carter further teaches that when the underlying substrate includes metal lines, inorganic acid mixtures are not suitable to remove the photoresist, as they will damage the metal lines. Various organic solvents, such as N-methyl-pyrrolidone (NMP), may be used to remove the undesired photoresist without harming the metal lines (col.1, lines 32-43). Thus, a skilled artisan, motivated by teaching of Carter, would have found it obvious to pre-treat the substrate of Yeol with an organic solvent, as disclosed by Carter, before the treatment step in order to loosen the surface of organic film, to ensure better diffusion of subsequent washing solution, and thus to achieve better removal in a shorter period of time.

With regard to claims 13 and 14 Yeol teaches that in addition, cleaning may be carried out as follows: after being washed with any of the aqueous cleaning solutions in the cleaning chamber 16, as shown in Fig.1, the substrate is washed with **super-pure water alone**, dried with **nitrogen gas** or the like, and then transferred to the discharge section. Yeol does not teach that the treatment is performed at a temperature not lower than 30^{o}C.

According to Carter all experiments were performed, while wafer was rotated the temperatures of treating solutions can be within the range of 0-100°C (col. 7, lines 35-37).

Based on the similarity of methods of Yeol and Carter and similarity of cleaning solutions and substrates to be cleaned, a skilled artisan would have found it obvious to

utilize the temperature range of Carter in a process of Yeol in order to ensure that sufficient concentration of ozone is present in water, and thus to arrive at the subject matter of claims 13 and 14.

Therefore, combination of references renders the above claims prima facie obvious and properly rejected under 35 USC 103 (a).

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Imaoka et al (U.S. 6, 290,777) discloses a method for cleaning substrates by washing with a solution comprising a hydrogen gas or ozone gas dissolved in ultrapure water; Haga et al (U.S. 6,325,359) discloses a method for cleaning substrates with ozonated water; Koizumi et al (U.S. 5,503,708) discloses a method for removing organic films from substrates by using ozone or ozone containing gas; Mitsumori et al (U.S. 6,086,057) discloses a method for substrate cleaning by using an oxidative gas dissolved in water, reductive gas dissolved in water or mixture of those gases dissolved in water; JP 8-78372 discloses a method, which involves washing a substrate after removing a resist by ashing. Other prior art indicated in PTOL-892 shows the general state of the art related to the instant claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Kornakov whose telephone number is (703) 305-0400. The examiner can normally be reached on 9:00am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on (703) 308-4333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872 9310 for regular communications and (703) 872 9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308 2450.

Michael Kornakov
Examiner
Art Unit 1746

M. KORNAKOV

December 13, 2002